

VII.—This was a secondary disturbance which developed in the southern portion of a more extended low area central north of Minnesota on the 26th. It was first central in Iowa and moved eastward over the lake region, attended by general rains north of the Gulf states. It increased in energy during the easterly movement until it reached the upper Saint Lawrence valley. The minimum pressure, 29.42, occurred at Saugeen on the 27th, when the storm was central near that station. Dangerous westerly winds occurred in the Lake region and heavy rains with southerly gales on the New England and middle Atlantic coasts during the passage of this disturbance. The latter conditions were probably due more to a secondary depression which developed in the south Atlantic states during the 26th.

VIII.—This storm was first observed as central over eastern Colorado and northern Texas on the 28th. An elliptical area of low pressure extended from the Rio Grande northeastward to the lower Missouri valley on the 28th, with an area of high pressure to the northward which apparently forced this disturbance to the eastward over the lower Mississippi valley. On the 29th it covered the greater portion of the Southern States and Ohio Valley, attended by heavy rains from the Lake region southward, which continued during the northeasterly

movement. After reaching the upper Ohio valley the disturbance separated, one centre of low pressure passing towards the coast over Virginia, while the other moved northward over the lower lakes. At the close of the month the southern disturbance was central in southern Virginia, attended by unusually heavy rains in the middle Atlantic states, and these rains continued during the succeeding day and caused destructive floods which form the subject of a special report in this REVIEW. On the back of chart i will be found supplementary charts giving the weather conditions attending the heavy rainfalls during the last days of May and the first of June over the region of destructive floods. It will be observed that the northern centre of disturbance, after reaching the Lake region, apparently divided, and at the close of the month two secondary depressions were indicated by the circulation of winds, one north of Lake Erie and one over southern Michigan. The development of the latter was especially favorable to the agricultural interests of the Northwest, as it caused a continuation of cloudiness, thereby preventing a destructive frost which must have occurred if clearing weather had prevailed on the morning of the 1st in the states north of the Ohio.

NORTH ATLANTIC STORMS FOR MAY, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during May, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depressions have been traced for May, 1889, the average number traced for the corresponding month of the last four years being ten. Generally fair weather prevailed and storms of unusual strength were not reported save on one date, the 21st, when gales of hurricane force were encountered off the middle Atlantic coast of the United States. Over the western part of the ocean a noteworthy feature was the advance northward from near the West Indies of two depressions. The remaining depressions passed eastward from the American continent, or first appeared over the ocean north of the fortieth parallel. Over mid-ocean strong gales were reported at intervals during the month. In the vicinity of the British Isles severe storms were not noted, although the barometric fluctuations were frequent and marked.

As compared with the corresponding month of previous years the depressions traced for May, 1889, were deficient in number and energy; they pursued normal tracks, and extreme low barometer readings noted in preceding years were not reported attending their passage. The following are brief descriptions of the depressions traced:

1.—This depression was a continuation of number 7 traced for April, 1889, and was central south of Ireland at noon, Greenwich mean time, of May 1st, with pressure falling to about 29.40 (747), and moderate to fresh gales to the twenty-fifth meridian. By the 2d the storm-centre had moved northwest over the British Isles, without evidence of marked strength.

2.—This depression was a continuation of low area xii for April, and on the 1st was central near the northeast coast of Newfoundland, with pressure below 29.60 (752) and fresh gales to the thirty-fifth parallel. Moving east to about longitude W. 39° by the 2d the depression is thence traced northeast to south of Iceland, where it disappeared after the 4th, attended throughout by fresh gales, and a gradual decrease in pressure.

3.—This depression was central over Newfoundland on the morning of the 4th, with pressure falling to about 29.60 (752), and fresh gales over and near the Grand Banks. By the 6th the storm-centre had moved east-northeast over mid-ocean north of the trans-Atlantic steamship routes, attended by fresh

to strong gales, whence it passed east-southeast and disappeared south of the British Isles during the 9th with an apparent decrease in energy after the 6th.

4.—The presence of this depression, about midway between Bermuda and the Bahamas, was indicated by reports of the 5th, to which region it had apparently advanced from the southward. On this date fresh northerly gales were reported north and northeast of the Bahamas. During the next four days the centre of depression moved slowly east of north to the thirty-seventh parallel, attended in the west quadrants by gales of moderate strength. The observer at Bermuda reports that on the 7th thunder-storms were observed all around the horizon from 3 a. m. until morning, and that very light showers prevailed on the island. After the 9th the depression apparently moved north-northeast to east of Nova Scotia, where it was central on the 10th, with pressure below 29.50 (749). From this position the storm-centre passed northeastward over Newfoundland, and thence eastward over the ocean, and disappeared south of the British Isles by the 14th, its passage being attended by a gradual decrease in energy.

5.—This depression appeared northeast of Newfoundland on the 8th and moved eastward to the thirtieth meridian by the 9th, attended by fresh to strong gales, and pressure below 29.40 (747). On the 10th the storm-centre was located west of Ireland, after which it moved eastward and disappeared over the British Isles with an apparent loss of energy.

6.—This depression is given an approximate path north of the West Indies from the 16th to 19th, during which period it possessed moderate energy. On the 19th the storm-centre was central in about N. 30°, W. 75', whence it recurved northward, and on the morning of the 21st was located in about N. 36°, W. 72'. During this date the depression apparently moved northward and united with an area of low pressure which occupied the Saint Lawrence valley. Reports indicate that the disturbances attending this depression were not severe in their character, save on the 21st, when gales of hurricane force were reported. The lowest barometric pressure, about 29.60 (752), was also noted on the 21st.

7.—This depression was a continuation of low area ii which advanced rapidly eastward over northern Newfoundland during the 15th. On the 16th and 17th the depression moved slowly north of east over mid-ocean north of the fiftieth parallel, attended by fresh to strong gales, after which it disappeared north of the region of observation.

8.—This depression was a continuation of low area v, and

by the morning of the 24th the centre of depression had advanced to western Nova Scotia, with pressure about 29.60 (752), and fresh to strong gales to the thirty-fifth parallel. By the 25th the storm-centre had moved rapidly northeastward and disappeared north of Newfoundland.

9.—This was a depression of considerable strength which appeared over mid-ocean in about latitude N. 56° on the 27th, moved eastward to the sixteenth meridian by the 28th, and disappeared north of the British Isles during the 29th, attended throughout by fresh to strong gales and pressure falling below 29.30 (744).

FOG IN MAY.

The following are limits of fog-areas on the north Atlantic Ocean during May, 1889, as reported by shipmasters:

Date.	Entered.			Cleared.			Date.	Entered.			Cleared.		
	Lat. N.	Lon. W.		Lat. N.	Lon. W.			Lat. N.	Lon. W.		Lat. N.	Lon. W.	
1	43 50	50 20		40 20	47 30		14-15	40 59	65 29		40 23	69 05	
3-4	42 08	50 56		43 30	53 40		14-15	46 07	54 34		47 48	60 20	
3-4	47 00	50 50		41 40	50 10		16	40 47	64 36		40 42	66 05	
3-5	47 00	50 50		46 30	55 50		16-17	41 00	59 00		40 30	64 00	
4	45 22	46 13		42 54	50 49		16-18	42 08	60 21				
4-5	43 15	46 50		42 31	50 50		17-18	40 00	65 00				
4-5	45 00	44 30		43 40	49 30		17-18	40 43	67 16				
6	42 45	54 20		42 40	55 10		19-20	40 00	65 58				
6-7	43 09	59 30		42 50	63 00		19-20	40 57	67 18				
7	41 19	60 05		41 18	61 15		21	38 31	74 30		38 43	74 22	
7-8	41 13	64 28		40 30	73 02		20-21	42 42	65 10		42 31	68 20	
7-8	42 35	66 05		42 24	70 20		21	40 52	66 50		40 48	67 33	
7-8	41 20	63 00		Off Sandy Hook.			21-22	42 35	60 23		40 55	67 59	
8	42 49	49 30		42 44	52 15		21-22	41 32	65 48		41 00	69 00	
8-9	41 30	64 11		40 23	69 16		22	42 50	64 00		42 30	68 00	
9	47 25	59 00		47 09	58 13		22	44 26	55 00		42 44	59 55	
9-10	40 27	72 04		40 47	63 00		22	41 38	63 58		40 57	66 48	
9-10	40 30	65 30		40 00	67 30		22-23	45 37	44 05		43 25	50 18	
10	40 44	65 30		40 45	68 35		22-23	41 50	63 15		41 00	68 05	
10	42 43	56 24		42 38	58 40		23	44 11	44 28		43 47	45 25	
10-11	43 24	48 57		42 13	56 09		25	42 50	49 27		42 32	50 15	
11	42 50	47 30		41 30	50 25		25-26	46 48	52 24		46 18	52 51	
11	44 08	47 27		43 10	50 18		26	41 10	64 00		41 00	65 30	
11	44 14	45 47		43 51	47 35		26-27	43 43	47 09		42 43	50 42	
11-12	42 09	49 45		43 11	47 29		27	41 23	66 12		41 13	66 45	
12	43 40	48 30		43 35	50 20		27-28	44 02	48 39		42 54	55 12	
13	41 00	65 40		Sandy Hook.			27-28	43 50	46 50		42 40	53 50	
13	40 27	71 49		40 24	73 50		28	46 58	52 47		46 32	53 24	
13-14	36 44	74 00		38 48	74 00		28	38 58	72 54		38 53	74 02	
13-14	40 12	67 22		42 18	70 25		28	40 44	68 22		40 36	69 47	
13-14	40 18	68 32		38 44	74 21		28	42 24	65 15		42 21	58 24	
14	40 58	66 55		40 32	71 27		29	41 04	67 00		41 02	67 16	
14	42 55	64 21		42 15	68 38		30	41 11	65 32		40 55	67 32	
14-15	40 18	72 24		40 14	69 15		30-31	42 47	65 16		41 25	66 46	

On chart i the limits of fog-belts west of the fortieth meridian are shown by dotted shading. Over and near the Banks of Newfoundland fog was reported on fifteen dates, as compared with nineteen dates for April, 1889, and seventeen dates for May, 1888. Between the fifty-fifth and sixty-fifth meridians fog was reported on fifteen dates, as compared with eighteen dates for April, 1889, and nine dates for May, 1888. West of the sixty-fifth meridian fog was reported on twenty dates, as compared with sixteen dates for April, 1889, and twenty-two dates for May, 1888. In the vicinity of the Grand Banks the development of fog attended the approach or passage of areas of low pressure, except on the 2d, when a depression was central near Bermuda, and on the 27th and 28th, when high pressure and variable winds prevailed. To the south and southeast of Nova Scotia fog was reported with the advance or passage to the northward of areas of low pressure, save from the 6th to 9th, inclusive, when a depression was advancing northward from near Bermuda, on the 16th, 17th, and 28th, when high barometer and variable winds, mostly southerly, prevailed, and on the 21st and 22d, with the advance northward of a depression off the middle Atlantic and New England coasts. West of the sixty-fifth meridian fog was reported on five dates with depressions central over the Gulf of Saint Lawrence or the lower Saint Lawrence valley; from the 7th to 9th, attending the northward passage of a depression from near Bermuda; from the 16th to 19th, with high barometer and variable winds, mostly from south to east; from the 20th to 22d, with the northward advance of a depression off the middle Atlantic and New England coasts, and from

the 27th to 31st with a gradual increase in pressure and variable and southerly winds.

Reports of the preceding two years indicate that May is the month of greatest fog frequency along and off the American coast west of the sixty-fifth meridian, and that the periods of greatest fog-prevalence south of Nova Scotia and over and near the Grand Banks occur during the summer months.

OCEAN ICE IN MAY.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for May during the last seven years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
May, 1883.....	40 30	47 00	May, 1883.....	45 40	45 12
May, 1884.....	41 30	47 30	May, 1884.....	43 30	44 50
May, 1885.....	40 50	48 15	May, 1885.....	42 30	40 10
May, 1886.....	41 36	51 30	May, 1886.....	48 55	46 13
May, 1887.....	39 38	46 00	May, 1887.....	39 38	46 00
May, 1888.....	41 00	46 00	May, 1888.....	41 00	46 00
May, 1889.....	43 07	55 47	May, 1889.....	49 46	36 48

The above table shows that for May, 1889, ice was reported about two degrees north and about eight degrees east of the average southern and eastern limits of ice for the month, as determined from reports of the preceding six years. In the current month icebergs were most frequently encountered off the northeast edge of the banks of Newfoundland; they were reported south of the forty-fifth parallel on two dates only, and east of the fortieth meridian on but one date. No icebergs or field ice were reported near the east or south coasts of Newfoundland save on the 2d, when a large berg was observed near Cape Spear, and icebergs were reported on but three dates west of the fiftieth meridian. As compared with the ice record for the preceding month there has been a large increase in the aggregate quantity of ice reported, while a comparison of the current month with the corresponding month of previous years shows that about the average quantity of ice for May was reported and that the ice region is contracted to the northward and extends to the eastward of the average limits of ice for the month.

The following positions of icebergs and field ice reported during the month are shown on chart i by ruled shading:

1st.—N. 46° 00', W. 46° 00', an iceberg.

2d.—East-northeast from Cape Spear, N. F., a very large berg.

3d.—N. 48° 15', W. 46° 51', two bergs; N. 47° 15', W. 47° 00', a long flat berg about fifty feet high and three hundred feet long; N. 47° 47', W. 46° 20', two medium-sized bergs, one conical and one flat; N. 43° 07', W. 55° 47', some field ice about twelve miles distant; N. 49° 47', W. 45° 06', a medium-sized berg; from N. 49° 13', W. 47° 10' to N. 48° 50', W. 48° 15', eight bergs; N. 50° 03', W. 44° 40', a large berg.

4th.—N. 49° 10', W. 46° 45', several bergs; from N. 48° 36', W. 48° 46' to N. 48° 24', W. 49° 15', four bergs; N. 49° 02', W. 47° 20', a number of large bergs for eighty-five miles on a S. 60° W. true course from the position given.

7th.—N. 46° 49', W. 46° 00', a large berg with lofty summit; N. 46° 50', W. 46° 30', a large round berg; N. 46° 56', W. 46° 35', a large round berg; N. 48° 47', W. 45° 36', a number of bergs and a quantity of field ice; last berg in N. 48° 34', W. 46° 15'.

8th.—N. 47° 57', W. 48° 54', the last berg of a number passed during the night on a south of west course.

9th.—N. 46° 26', W. 44° 22', a very large berg; N. 46° 51', W. 45° 22', a large berg one and one-half miles to southward; N. 49° 46', W. 36° 48', a small berg.

10th.—N. 48° 09', W. 44° 24', a piece of ice apparently broken from a large berg; N. 48° 07', W. 44° 28', a large berg; N. 48° 03', W. 44° 36', a medium-sized berg; N. 47° 33', W. 45° 41', a large berg; N. 48° 30', W. 46° 10', several small bergs and a quantity of field ice; N. 48° 04', W. 49° 48', a

medium-sized berg; N. 49° 19', W. 49° 09', one large and two small bergs; N. 48° 00', W. 46° 00' to N. 47° 37', W. 46° 30', several large bergs and a large quantity of small detached pieces; very dangerous.

12th.—N. 47° 40', W. 44° 05', a large berg; N. 47° 26', W. 45° 00', three large bergs three miles apart east and west; N. 47° 14', W. 46° 00', a very large berg with flat top and perpendicular sides.

13th.—N. 48° 03', W. 49° 48', a small berg; N. 48° 16', W. 49° 19', three small bergs.

13-14th.—N. 46° 55', W. 47° 10' to N. 48° 08', W. 44° 01', six bergs and many pieces of ice.

14th.—N. 46° 54', W. 45° 00', large bergs about eighty feet high.

15th.—N. 48° 10', W. 49° 03', a very large berg; N. 48° 00', W. 49° 48', a very large berg and several small pieces to leeward.

16th.—N. 47° 35', W. 42° 35', a berg fifty feet high and three hundred feet long.

17th.—N. 46° 25', W. 42° 53', a berg seventy feet high and three hundred and fifty feet long; N. 46° 54', W. 42° 00', a berg about forty feet high and one hundred and fifty feet long one mile distant; N. 48° 10', W. 49° 10', several large bergs.

18th.—N. 48° 30', W. 50° 40', ten or twelve bergs; N. 48°

32', W. 48° 43', 10 a. m., passed several small bergs, and continued passing them until 4 p. m., when they set in thick, some being over one hundred feet high and four hundred feet long.

19th.—N. 47° 27', W. 48° 20', five large bergs from 9 a. m. till noon; N. 48° 10', W. 47° 05', two large bergs.

21st.—N. 46° 53', W. 46° 05' to N. 46° 40', W. 47° 10', twelve bergs, some large ones.

22d.—N. 46° 23', W. 42° 19', one long low-lying berg, with detached pieces, and a large piece of ice one mile to southward; N. 48° 18', W. 49° 08', one large and two small bergs; N. 48° 06', W. 48° 59', one large berg and several small pieces.

24th.—N. 45° 14', W. 40° 43', a small berg; N. 47° 53', W. 48° 00', one medium-sized berg.

26th.—N. 46° 45', W. 43° 05', a berg about one hundred and fifty feet high.

30th.—N. 45° 40', W. 45° 16', a medium-sized berg with one high peak.

30-31st.—N. 48° 51', W. 47° 07' to N. 48° 03', W. 50° 21', numerous large bergs.

31st.—N. 44° 35', W. 48° 30', three bergs within two to three miles; N. 47° 43', W. 44° 16', three bergs; N. 45° 34', W. 47° 30' to N. 45° 22', W. 48° 00', six small bergs; N. 48° 50', W. 47° 26' to N. 48° 15' W. 49° 01', several bergs, large and small.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for May, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above.

For May, 1889, the mean temperature was highest in the middle and lower Colorado and the lower Gila valleys, where, at stations, the values rose above 80°, the highest mean reading, 84°.2, being reported at Mammoth Tank, Cal. Over southern and west-central Florida, the lower Rio Grande valley, the extreme southwestern part of New Mexico, southern Arizona, adjoining parts of California, southern Nevada, and Arizona, and within a limited area in east-central California, the mean temperature was above 75°. The mean readings were above 70° south of a line traced from Wilmington, N. C., irregularly westward to southern New Mexico, over southwestern Arizona, the western half of California south of the thirty-eighth parallel, and within limited areas in northwestern Nevada, central Kansas, and adjoining parts of west-central Tennessee and Arkansas. The lowest mean temperature for the month was noted at stations in central Colorado, where it fell below 40°. The mean values were below 50° in the lower Saint Lawrence valley, over Lake Superior and northern Lake Huron, and in the Canadian Northwest Territories.

The mean temperature was above the normal in New England, at a majority of stations in the eastern portions of the middle Atlantic and south Atlantic states, and within an area extending from the north Pacific coast and Columbia valley southeastward to Arizona, New Mexico, and northern Texas; in all other districts the temperature was generally below the normal. The greatest departures above the normal were noted in New Brunswick and Nova Scotia, where they exceeded 6°. The departures below the normal were small and nowhere amounted to 5°.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.		Below normal.	
Chatham, N. B.	8.0	Fort Buford, Dak.	4.8
Boston, Mass.	4.3	Mobile, Ala.	4.5
Spokane Falls, Wash.	3.0	Abilene, Tex.	4.5
Fort Apache, Ariz.	2.8	San Francisco, Cal.	4.2
Kitty Hawk, N. C.	2.5	Louisville, Ky.	3.9

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for May, 1889; (4) the departure of the current month from the normal; (5) the extreme monthly means for May during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of May.	(2) Length of record.	(3) Mean for May, 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for May.			
						Highest.	Year.	Lowest.	Year.
<i>Arkansas.</i>		°	Years	°	°				
Lead Hill	Boone	68.0	7	67.9	-0.1	74.4	1886	62.9	1883
<i>California.</i>									
Sacramento	Sacramento	64.3	36	61.4	-2.9	70.2	1865	58.5	1860
<i>Colorado.</i>									
Fort Lyon	Bent	63.4	20	60.1	-3.3	68.8	1879	58.9	1873
<i>Connecticut.</i>									
Middletown	Middlesex	57.0	22	60.0	+3.0	61.3	1864	52.4	1861
<i>Florida.</i>									
Merritt's Island	Brevard	75.2	5	73.9	-1.3	79.2	1884	70.3	1886
<i>Georgia.</i>									
Forayth	Monroe	72.8	15	73.5	+0.7	75.8	1880	69.2	1877
<i>Illinois.</i>									
Peoria	Peoria	64.7	33	62.6	-2.1	71.4	1881	55.2	1867
Riley	McHenry	57.3	33	55.6	-1.7	64.4	1881	49.8	1867
<i>Indiana.</i>									
Vevay	Switzerland	65.1	22	64.2	-0.9	71.2	1880	60.4	1867
<i>Iowa.</i>									
Cresco	Howard	56.6	17	56.0	-0.6	64.1	1881	49.9	1888
Monticello	Jones	59.5	35	59.9	+0.4	68.1	1881	51.8	1867
Logan	Harrison	62.2	15	62.7	+0.5	71.3	1880	56.1	1878
<i>Kansas.</i>									
Lawrence	Douglas	65.1	27	64.2	-0.9	70.6	1880	55.5	1867
Wellington	Sumner	65.0	10	66.4	+1.4	71.1	1880	58.2	1882
<i>Louisiana.</i>									
Grand Coteau	Saint Landry	74.9	6	73.2	-1.7	75.7	1884	73.2	1889
<i>Maine.</i>									
Gardiner	Kennebec	53.3	49	56.7	+3.4	57.0	1880	49.1	1856
<i>Maryland.</i>									
Cumberland	Allegany	59.8	26	62.9	+3.1	67.0	1880	51.1	1866